

Safety

Describe the collection of wastewater.

Discuss the shut-down of surface aerators.

Discuss safety in operation of the floating cover of an anaerobic digester.

Describe the toxic and harmful chemicals encountered at a wastewater treatment plant.

Describe the dangerous and explosive gases encountered in sewer and at a wastewater treatment plant.

Discuss the hazard of electrical shock while working at a wastewater treatment plant.

Discuss the safety precautions necessary for operation of a biological-mechanical wastewater treatment plant.

Discuss water supplies for a wastewater treatment plant.

Discuss a Material Safety Data Sheet (MSDS).

Maintenance

Discuss preventive maintenance records.

Discuss the maintenance of chlorinators.

Describe centrifugal pumps and their maintenance rules.

Discuss the operation of piston pumps.

Describe progressive cavity pumps.

Compare mechanical seals and packing seals for a pump.

Discuss the maintenance of belt drives of a pump.

Describe the maintenance of chain drives.

Describe the maintenance of couplings for a pump.

Discuss the function of shear pins for a pump.

Describe the job of a dehumidifier for wastewater treatment units.

Discuss plugged pipelines.

Discuss the biological generation of odors.

Study glossary on solids removal from secondary effluent.

Discuss instruments and controls.

Describe the accuracy of instrumental measurement.

Describe pressure gages.

Describe water level measuring devices.

Describe the controllers in an instrument system.

Pretreatment

Describe the objectives of the National Pretreatment Program and its origin.

Define a Significant Industrial User (SIU).

When are Control Authorities required to inspect SIUs.

A POTW's requirement to develop and implement a pretreatment program is a condition of what?

Preliminary Treatment

Describe safety around bar screens and racks.

Discuss manually cleaned bar screens.

Describe mechanically cleaned screens.

Describe the function of comminutors.

Discuss the need for grit removal.

Describe grit channels.

Describe cyclone grit separators.

Discuss grit washing.

Discuss operational strategy of pretreatment treatment.

Sedimentation

Discuss the purpose of sedimentation and flotation.

Discuss the start-up procedure of a clarifier.

Describe the operational strategy of clarifiers.

Discuss floating sludge in a clarifier.

Describe typical clarifier efficiencies.

Describe the response to poor clarifier performance.

Describe sludge and scum pumping.

Discuss primary clarifier operation.

Discuss the operation of trickling filter clarifiers.

Discuss the operation of activated sludge clarifiers.

Discuss safety while working with clarifiers.

Describe the flotation process.

Describe septic tanks.

Activated Sludge

Discuss the use of package activated sludge plants.

Describe the types of package plant treatment processes.

Describe the aeration methods in the activated sludge process.

Discuss wasting sludge from package extended aeration plants.

Describe laboratory testing for package plants.

Describe the flow path for oxidation ditch.

Discuss plant start-up of oxidation ditch.

Describe the normal operation of an oxidation ditch.

Discuss the abnormal operation of an oxidation ditch.

Describe the variation in activated sludge process.

Discuss air filters for blowers in the activated sludge process.

Describe blowers from the activated sludge process.

Discuss air diffusers used in the activated sludge system.

Describe safety in the operation of surface aerators.

Consider safety in the use of air header and diffusers.

Discuss the control of the activated sludge process.

Discuss wasting activated sludge.

Discuss plant changes in the activated sludge process.

Discuss sludge bulking.

Discuss septic sludge in the activated sludge process.

Describe rising sludge.

Discuss foaming/frothing in the activated sludge process.

Discuss troubleshooting of the activated sludge process.

Discuss the use of loading guidelines in the activated sludge process.

Describe the contact stabilization process.

Discuss the complete-mix type of activated sludge system.

Discuss the importance of microbiology in the activated sludge process.

Discuss the sampling location for routine microbiological tests.

Describe the procedures for preparing microbiological samples.

Describe the microorganisms of importance.

Describe the desirable and undesirable microorganisms.

Discuss three methods of RAS flow rate control.

Describe the purpose of wasting activated sludge.

Discuss the operational strategy for high organic waste loads.

Discuss methods to control the flow in the activated sludge process.

Discuss the need for effluent nitrification.

Describe the factors affecting biological nitrification.

Fixed Film

Discuss the principles of the trickling filter treatment process.

Discuss the principles of operation of trickling filters.

Describe the daily operation of trickling filters.

Discuss responses to poor trickling filter performance.

Describe odor control for a trickling filter.

Discuss the filter fly problem for trickling filters.

Discuss sloughing in a trickling filter.

Describe the cold weather problems of a trickling filter.

Describe computing the hydraulic loading to a trickling filter.

Describe computing the organic loading to a trickling filter.

Describe rotating biological contactors.

Discuss the pretreatment requirements for an RBC.

Describe what to look for on RBC media.

Disinfection

Discuss disinfection.

Describe the reaction of chlorine in wastewater.

Discuss the inorganic reducing material reacting with chlorine.

Describe the reaction of chlorine with ammonia.

Discuss the factors influencing disinfection.

Discuss collection system disinfection.

Describe plant chlorination.

Describe chlorinator control.

Discuss measurement of the chlorine residual.

Describe a chlorine safety program.

Describe chlorine hazards and why chlorine must be handled with care.

Discuss the handling of chlorine cylinders.

Discuss chlorine leaks.

Discuss the installation and maintenance of chlorination facilities.

Discuss the need for dechlorination.

Describe the properties of sulfur dioxide.

Understand how UV disinfection works.

Understand what kind of light is used in UV disinfection.

Laboratory, Sampling & Monitoring

Describe chemical names and chemical formulas.

Describe laboratory equipment.

Discuss the term "solutions".

What is the term "titration"?

Discuss the use of a spectrophotometer.

Discuss the corrosive chemicals found in laboratories.

Describe the toxic chemicals found in a laboratory.

Discuss proper laboratory techniques.

Discuss the importance of sampling.

Describe the types of samples collected at a wastewater treatment plant.

Describe the proper preservation of samples.

Describe the tests for settleable solids.

Describe the suspended solids test.

How do you determine volatile solids.

Discuss the measurement of the sludge volume index.

Discuss the measurement of D.O. in the aeration tanks.

Describe the alkalinity test procedure.

Describe the COD test procedure.

Describe the term "buffer".

Describe the D.O. tests.

Describe the BOD tests.

Describe the pH tests.

Discuss the measurement of metals in wastewater.

Define a "standard solution"

Discuss the need for analyzing and presenting data.

Describe the causes of variation in laboratory test results.

Discuss the term "sampling".

Describe the terms "manometer" and "gage reading".

Discuss the importance of records.

Discuss annual reports.

Solids Treatment & Handling

Discuss the purpose of anaerobic sludge digestion.

Describe pipelines and values for anaerobic digesters.

Discuss digester mixing.

Compare anaerobic and aerobic digestion.

Discuss the operation of the aerobic digestion process.

Describe sludge drying beds.

Describe sludge disposal methods.

Discuss the purpose of sludge thickening.

Discuss the purpose of sludge stabilization.

Describe the factors affecting aerobic digestion.

Discuss the purpose of dewatering.

Describe a belt filter press.

Describe the factors affecting sand drying beds.

Discuss troubleshooting of the operation of sand sludge drying beds.

Describe composting.

Discuss the need for land disposal of sludge.

Physical-Chemical Treatment

Discuss the need for odor control.

Describe the generation of hydrogen sulfide.

Discuss odor identification and measurement.

Describe remedies (solutions) to odor problems.

Discuss chlorination for odor control.

Describe masking, modification and counteraction.

Discuss good housekeeping relative to odor control.

Discuss the need to remove solids from secondary effluents.

Describe the use of alum.

Discuss the use of polymeric flocculants.

Describe jar tests.

Discuss solids removal from the secondary effluent using microscreens.

Discuss the use of gravity rapid sand filters for effluent polishing.

Describe the backwashing process of rapid sand filters.

Discuss the filter media for rapid sand filters.

Describe the used backwash water holding tank.

Discuss phosphorus as a nutrient.

Describe the use of alum for nutrient and suspended solid removal.

Mathematics

Given the dimensions of a clarifier and the flow rate, calculate the detention time.

Given the diameter of a trickling filter and the flow rate, calculate the hydraulic surface loading.

Given a flow rate and the pounds of chlorine being fed, calculate the chlorine dosage.

Given the residual chlorine concentration and the chlorine dosage, calculate the chlorine demand.

Given the average flow rate and the average effluent BOD concentration for the month, calculate the poundage of BOD discharged for the month.

Given the dimensions of a wet well and the drop of water level, calculate the pump capacity.

Given the D.O. of the receiving water and the saturation D.O. of the water at the temperature, calculate the percent saturation.

Given the desired sludge and the daily primary effluent suspended solids, calculate the desired poundage of suspended solids in the aeration tanks.

Given the diameter and stroke of a piston pump, calculate the volume delivered per stroke.

Given volume of sludge pumped to a digester and the total solids content, calculate the pounds of dry solids subject to digestion.

Given the volume of an aeration tank and the concentration of MLSS, calculate the poundage of MLSS under aeration.

Given the total flow through an aerator and the return sludge flow ratio, calculate the return activated sludge rate.

Given the dimensions of an aerobic digester and the flow rate, calculate the detention time.

Given the influent and effluent phosphorus concentration, calculate percent removal of phosphorus.

Given the dimensions of a sludge drying bed and the depth of sludge applied, calculate the volume of sludge applied.

Formula Sheet for the Class II
Revised 05/02

F025

$$\text{Detention time, hrs} = \frac{(\text{Tank volume, cf}) (7.48) (24, \text{ hrs})}{\text{Flow, gpd}}$$

F026

$$\text{Hydraulic loading, gpd/sf} = \frac{\text{Flow rate, gpd}}{\text{Surface area, sf}}$$

F027

$$\text{Chlorine dose, mg/l} = \frac{\text{Chlorine, lbs}}{(\text{Flow rate, mgd}) \times (8.34)}$$

F028

$$\text{Chlorine demand, mg/L} = \text{Chlorine dosage, mg/L} - \text{residual chlorine, mg/L}$$

F029

$$\begin{aligned} \text{BOD load, lbs BOD/month} &= \\ (\text{BOD conc, mg/l}) \times (\text{average flow rate, mgd}) \times (8.34) \times (30 \text{ days/month}) \end{aligned}$$

F030

$$\text{Pump capacity, gpm} = \frac{(\text{Width}) \times (\text{length}) \times (\text{draw-down, cf} \times 7.48)}{\text{Time of draw-down, in minutes}}$$

F031

$$\begin{aligned} \text{D.O. saturation, \%} &= \\ \frac{(\text{D.O. of receiving water, mg/L}) \times (100\%)}{\text{D.O. at 100\% saturation, mg/L}} \end{aligned}$$

F032

$$\text{Desired suspended solids, lbs} = (\text{Sludge age, days}) \times (\text{primary effluent solids, lb/day})$$

F033

$$\text{Volume per stroke, gal/stroke} = \frac{(0.785) \times (\text{diameter, inch})^2}{(12)^2} \times \frac{(\text{stroke, inch}) \times (7.48)}{12}$$

F034

$$\text{Total dry solids, lbs} = \frac{(\text{Raw sludge, gal}) (\text{total solids, \%}) (8.34)}{100\%}$$

F035

$$\text{MLSS, lbs} = (\text{Aeration volume, MG}) \times (\text{MLSS conc, mg/L}) \times (8.34)$$

F036

$$\text{Return sludge rate, mgd} = (\text{Total flow, MGD}) (\text{Return sludge flow ratio})$$

F037

$$\text{Digestion time, days} = \frac{\text{Digester volume, gal}}{\text{Flow, gpd}}$$

F038

$$\text{Phosphorus (P) removal, \%} = \frac{(\text{Influent P, mg/L} - \text{effluent P, mg/L}) (100\%)}{\text{Influent P, mg/L}}$$

F039

$$\text{Sludge applied, gal} = \frac{(\text{Area, sf}) \times (\text{depth of application, in}) \times (7.48)}{12 \text{ in / ft}}$$

F012

$$\begin{aligned} \text{Solids loading, lbs/day} &= \\ (\text{Flow, MGD}) \times (\text{influent TSS, mg/L}) \times 8.34 \end{aligned}$$

F016

$$\begin{aligned} \text{Average flow rate, MGD} &= \\ \frac{(\text{Final flow, MG}) - (\text{initial flow, MG})}{\text{Time elapsed, days}} \end{aligned}$$

F018

$$\begin{aligned} \text{TSS removal efficiency, \%} &= \\ \frac{(\text{Influent TSS} - \text{effluent TSS})}{\text{Influent TSS}} \times 100\% \end{aligned}$$

F022

$$\begin{aligned} \text{Chlorine feed rate, lbs/day} &= \\ (\text{Flow, MGD}) \times (\text{dosage, mg/L}) \times 8.34 \end{aligned}$$

F028

$$\begin{aligned} \text{Chlorine demand, mg/L} &= \\ \text{Chlorine dosage, mg/L} - \text{residual chlorine, mg/L} \end{aligned}$$